

AFRL-RX-TY-TP-2008-4535

POSTPRINT



**AIR FORCE RESEARCH LABORATORY
RESEARCH ON AUTONOMOUS AND NON-
DESTRUCTIVE PAVEMENT SURFACE
ASSESSMENT**

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JULY 2007

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**This briefing was presented at the US-Israel Air Force Project Agreement
Conference held in Tel-Aviv, Israel from 27 July to 04 August 2007.**

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AFRL Research on Autonomous and Non-Destructive Pavement Surface Assessment

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Overview



- **Introduction**
- **Non-Destructive Airfield Evaluation**
 - **Non Contact System**
 - **Rolling Weight Deflectometer**
 - **Optical Correlation System**
- **Damage Assessment**
 - **Rapid Airfield Damage Assessment**
 - **Runway Roughness Studies**



Introduction



- Problems with current Pavement Evaluation Methods

- Pavement coring
 - Lengthy, tedious
 - Adds repair work to assessment



Destructive



Discrete

- Non-continuous information
Pavement properties estimated between samples (cores, DCP)



Introduction



Bulky / Massive

- Massive equipment
The size of current assessment technologies is too large to implement on deployed airfields (HWD)

- Cost: Time and Money
Current structural assessment techniques require many days and personnel (PCI). This adds to the cost and is inappropriate for front lines.



Time Consuming - Cost



Introduction



- **Goal:**
 - Simplify assessment process
 - Avoid destructive procedures
 - Provide continuous measurements
 - Miniaturize survey tools
 - Expedite assessment methods
 - Increase accuracy



Structural Assessment



- Structural Assessment Tools
 - Non Contact System
 - Rolling Weight Deflectometer
 - Optical Correlation System

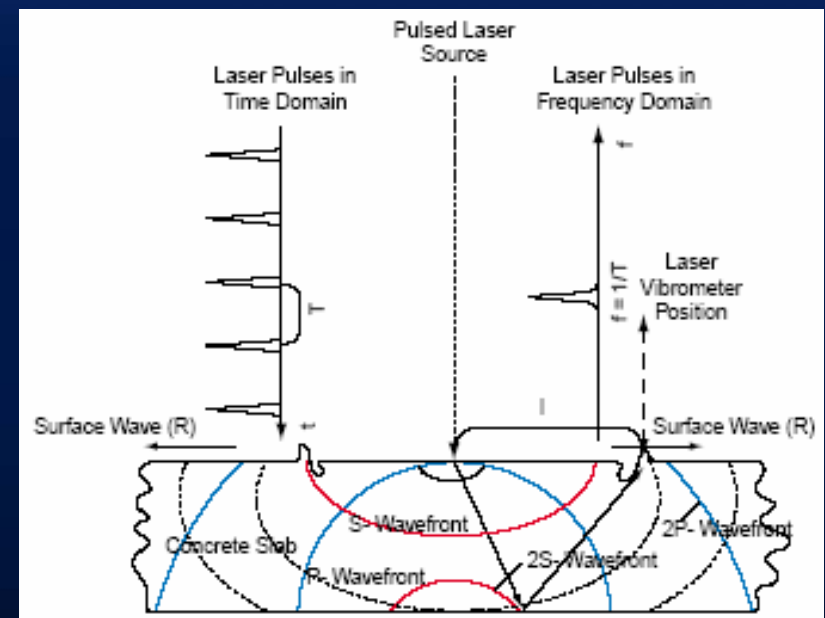
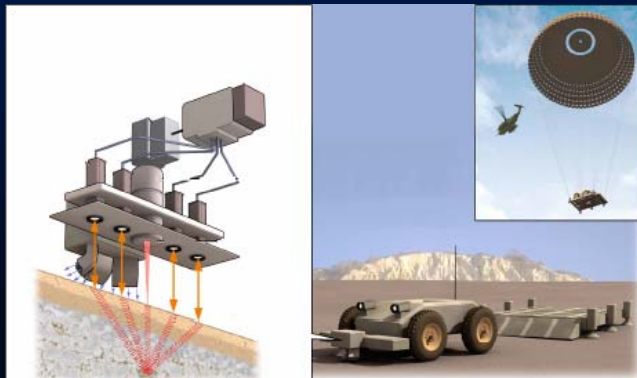


Non Contact System



- **Laser Ultrasonic Non-contact Seismic System**

- Laser Pulse Excites Pavement Surface
 - thermal strain
 - ablation recoil
- Laser Vibrometer analyzes seismic activity
- Provides multilayer thickness information
- Coupled with density gauge will provide Pavement Modulus information
- Potential Robotic Application

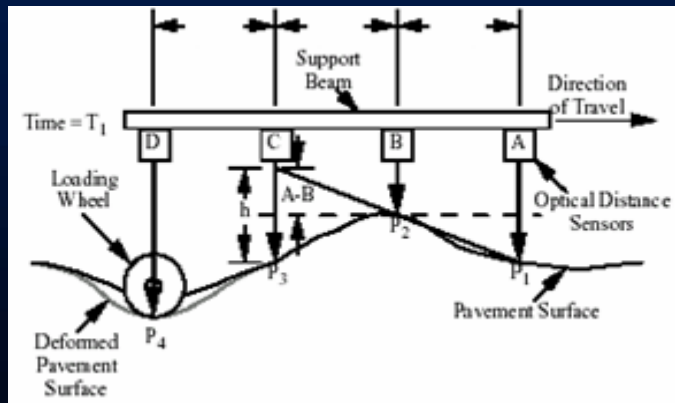
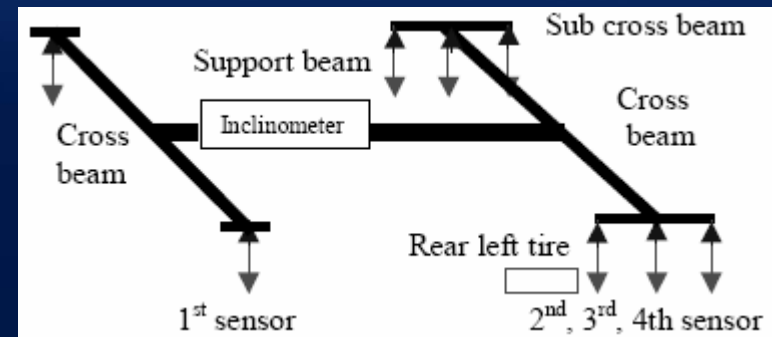




Rolling Weight Deflectometer



- Miniaturize Rolling Weight Deflectometer
 - Current RWD are too big
 - Goal: Mount on a Dump Truck
 - Challenges:
 - Provide enough mass for airfields
 - Stabilized sensor package
 - Vary sensor location
 - Study various laser ranging techniques

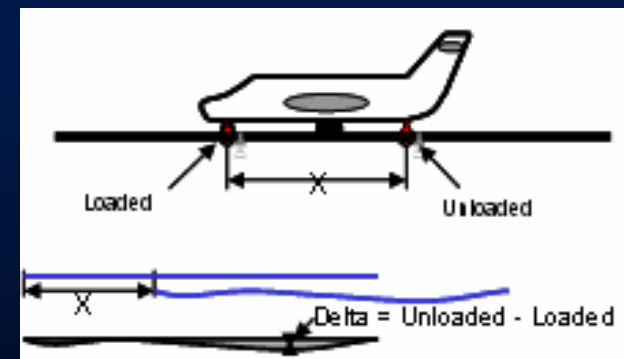




Optical Correlation



- Optical Correlation Methodology
 - Deflection basin determined by cameras
 - Early stages of development

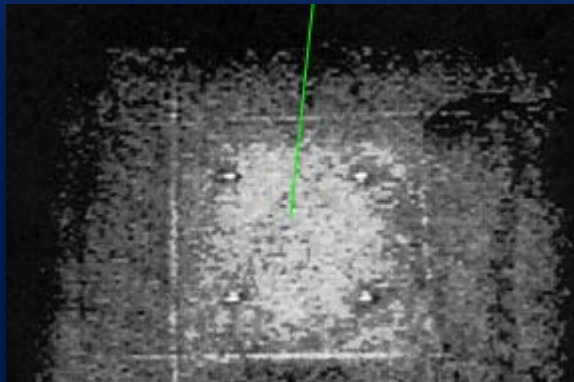




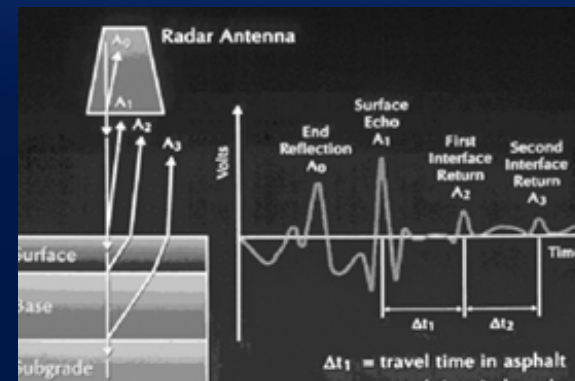
Rolling Weight Deflectometer



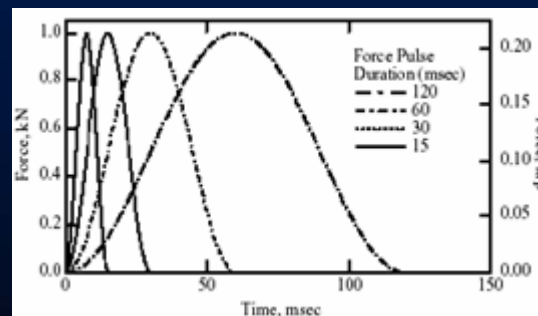
- Incorporating other assessment technologies



IR Imaging



Ground Penetrating Radar



Falling Weight Deflectometer



Damage Assessment



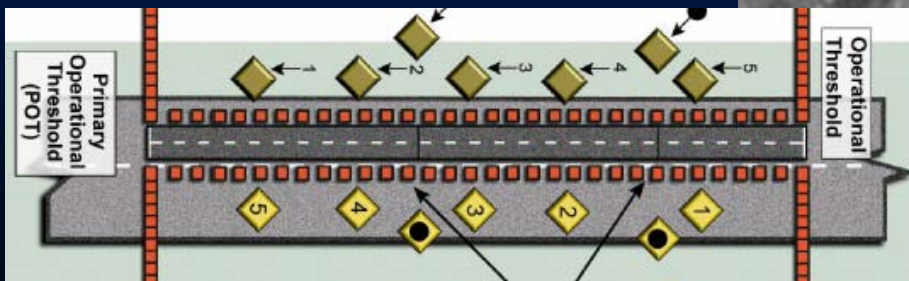
- Damage Assessment Methodologies
 - Rapid Airfield Damage Assessment
 - Pavement roughness assessment



Airfield Damage Assessment



- Current Method
 - Airfield Damage Assessment Team is dispatched
 - Damage is surveyed (ie craters, spalls, bomblets) and manually plotted
 - Minimum Operating Strip is determined
- Shortfalls
 - Inaccurate and time consuming
 - Requires minimum of seven people

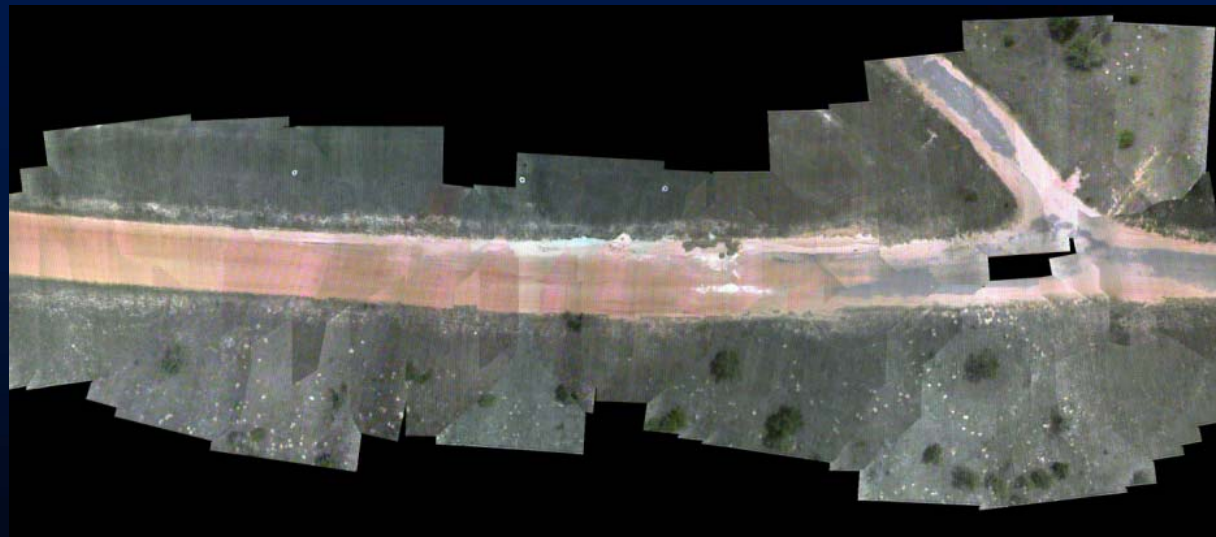
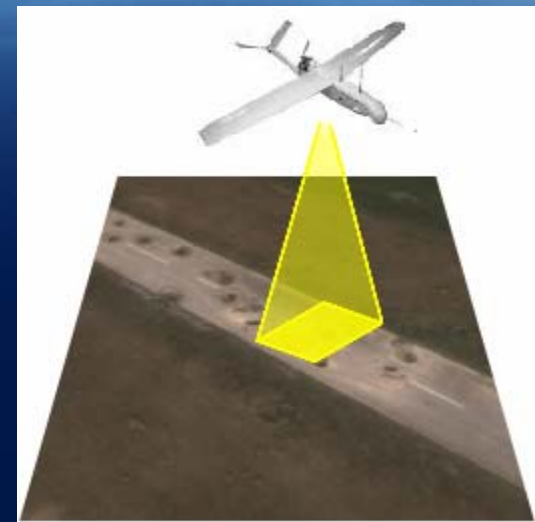




Airfield Damage Assessment



- Solution:
 - Unmanned-Air-Vehicle assessment
 - Geo-referenced Imagery
 - Computerized Approach
 - Reduces necessary manpower
 - Decreases assessment time
 - Increases accuracy

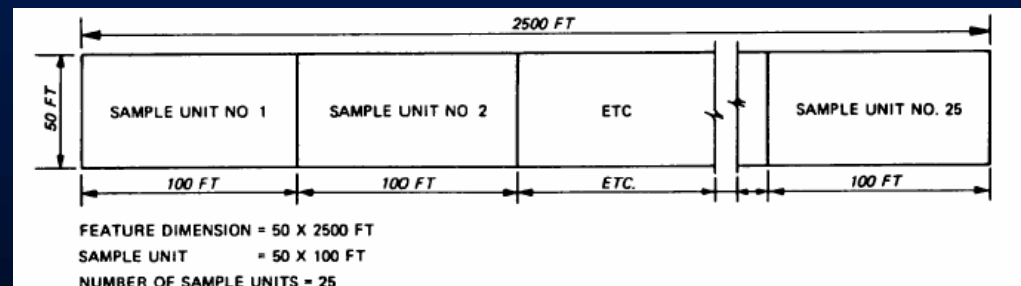




Pavement Roughness



- Current assessment concerns
 - Too lengthy for deployed environment.
 - Focus on pavement structure, not aircraft
 - Does not provide adequate go / no go decision making criteria

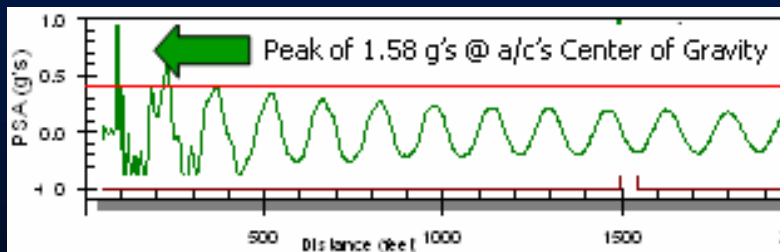




Pavement Roughness



- Solution
 - Analyze aircraft interaction with surface roughness
 - Develop accurate numerical models to assess loads
 - Provide decision making tool for field assessment teams
- Needs
 - Validate models
 - Live aircraft testing





Summary



- **Introduction**
- **Non-Destructive Airfield Evaluation**
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Aircraft Operating Surfaces



Questions?

